

45nm Product Press Briefing

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Corporate Vice President
Director of Group Operations
Digital Enterprise Group



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- Today's presentation contains forward-looking statements. All statements made that are not historical facts are subject to a number of risks and uncertainties, and actual results may differ materially. Please refer to our most recent Earnings Release and our most recent Form 10-Q or 10-K filing available on our website for more information on the risk factors that could cause actual results to differ.



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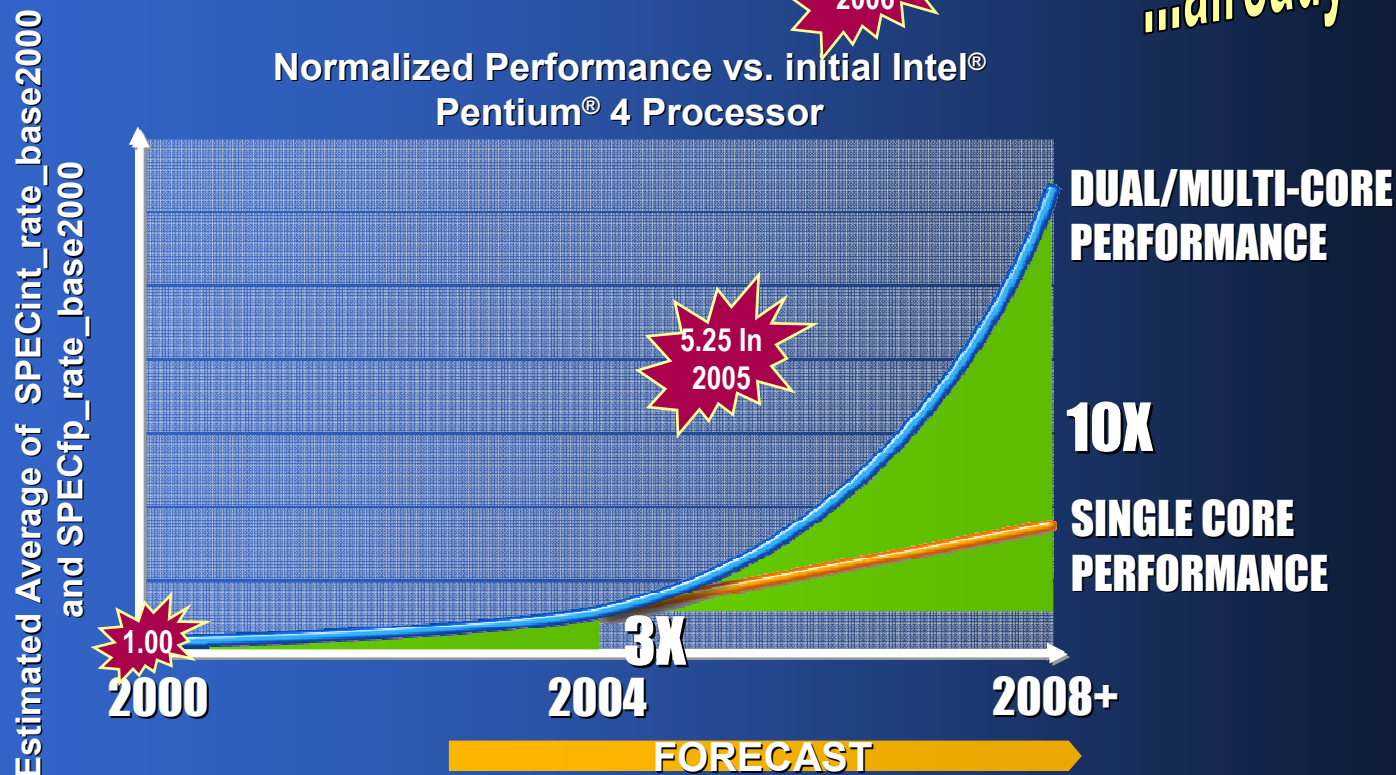
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How can Intel achieve 10X performance over time?

- Deliver Parallel Computing
- Design Power Efficient Architectures
- Focus on Platform and Usage Models

From 2004 press briefing
...already exceeded



Source: Intel
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See <http://www.spec.org> for more information
Estimates as of September 2007

SPEC_rate_base2000 used due to historical nature of the chart



Agenda

- Intel® 45nm Manufacturing Technology
- Enhanced Intel® Core™ Microarchitecture
- Intel® 45nm Products & Platforms
- Summary



45nm Status

- 1st generation revolutionary high-k + metal gate transistors for improved performance and reduced leakage power
- Working “Penryn” microprocessors were first demonstrated in January '07 and “Silverthorne” microprocessors in April '07
- Intel’s 45nm processors are 100% lead-free
- Intel 45nm CPUs will convert to halogen-free packaging technology by the end of 2008
- Intel’s 45nm process technology will be described in more detail at the International Electron Devices Meeting (10-12 Dec'07)

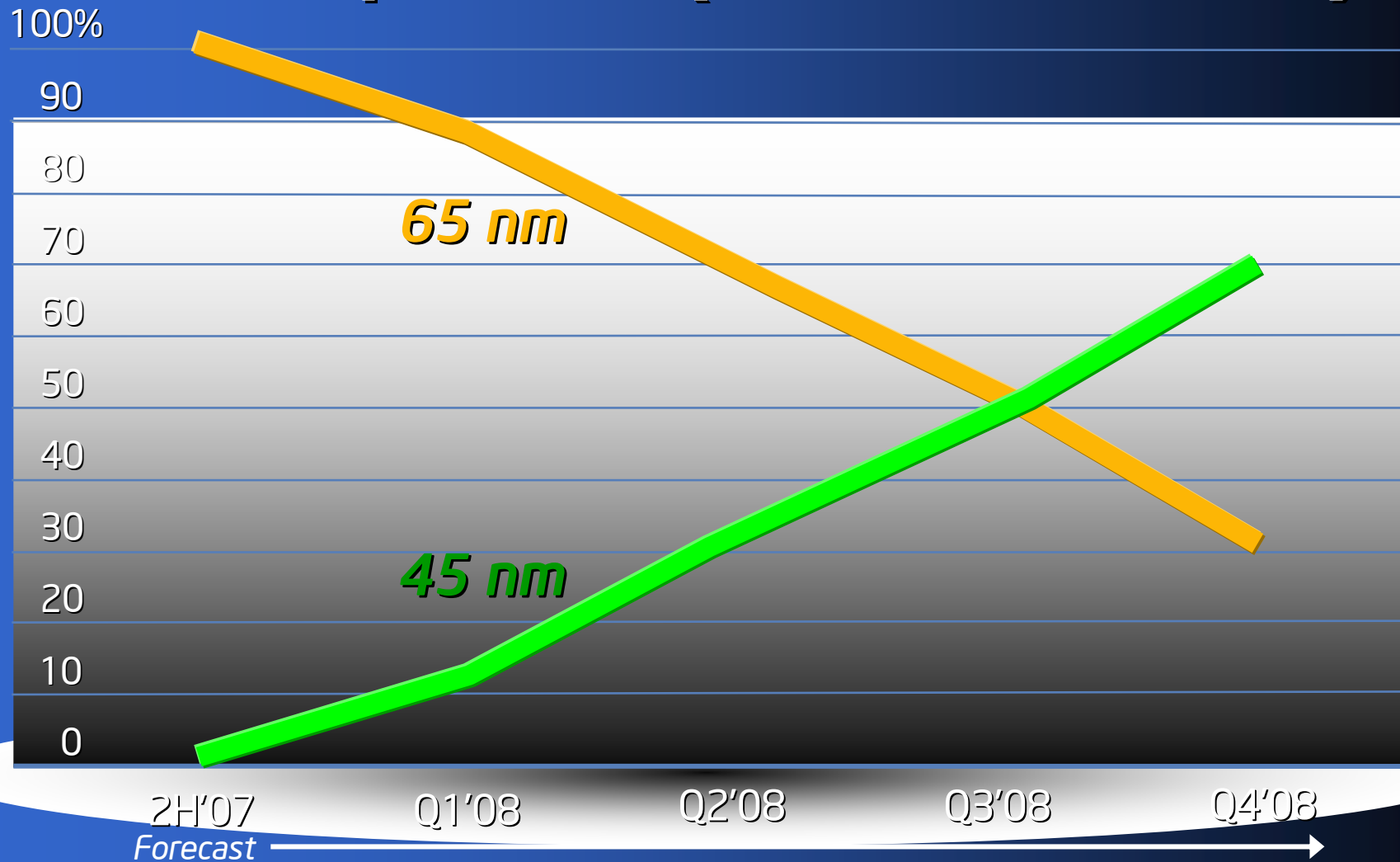
45nm High-k = Fundamental, Game-Changing Technology



Yield on Track for 45nm Production



CPU Shipments (65nm vs. 45nm)

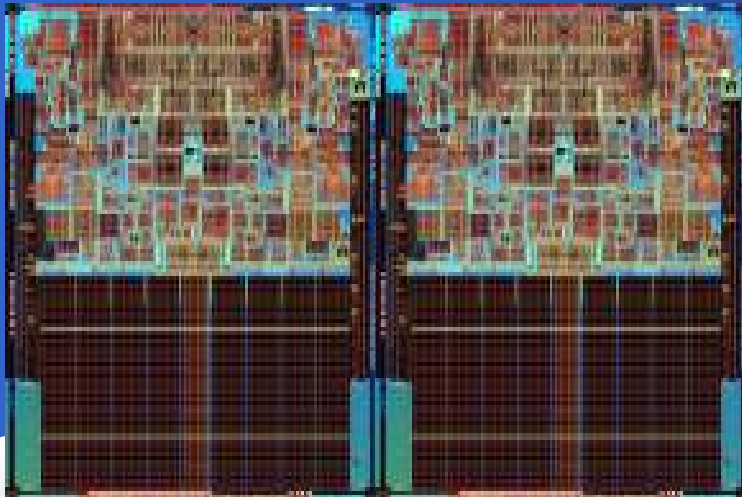


Source: Intel Internal



45nm Advantage

Intel® Xeon® Processor 5300 series
(Clovertown)
65nm

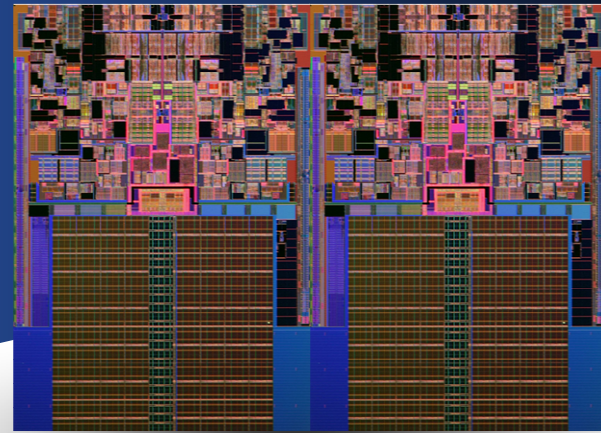


143 mm^{2*}

143 mm^{2*}

582m Transistors
8 MB Cache

Intel® Xeon® Processor 5400 series
(Harpertown)
45nm Hi-k



107 mm^{2*}

107 mm^{2*}

820m Transistors
12 MB Cache

*Source: Intel
Die image size proportion is approximate

Enhanced Intel® Core™ Microarchitecture

Today's 65nm Intel Core
Microarchitecture

45nm Enhanced Intel Core
Microarchitecture (*Penryn*)

Intel® Wide Dynamic Execution

Fast Radix-16 Divider
Faster OS Primitive Support
Enhanced Intel Virtualization Technology

Intel® Advanced Smart Cache

Larger L2 Cache: up to 12MB
24 Way Set Associativity

Intel® Smart Memory Access

Improved Store Forwarding
Higher bus speeds

Intel® Advanced Digital Media Boost

Intel SSE4 instructions
Super Shuffle Engine

Intel® Intelligent Power Capability

Deep Power Down Technology*
Enhanced Dynamic Acceleration Technology*

* Mobile only features

New Levels of Energy-Efficient Performance



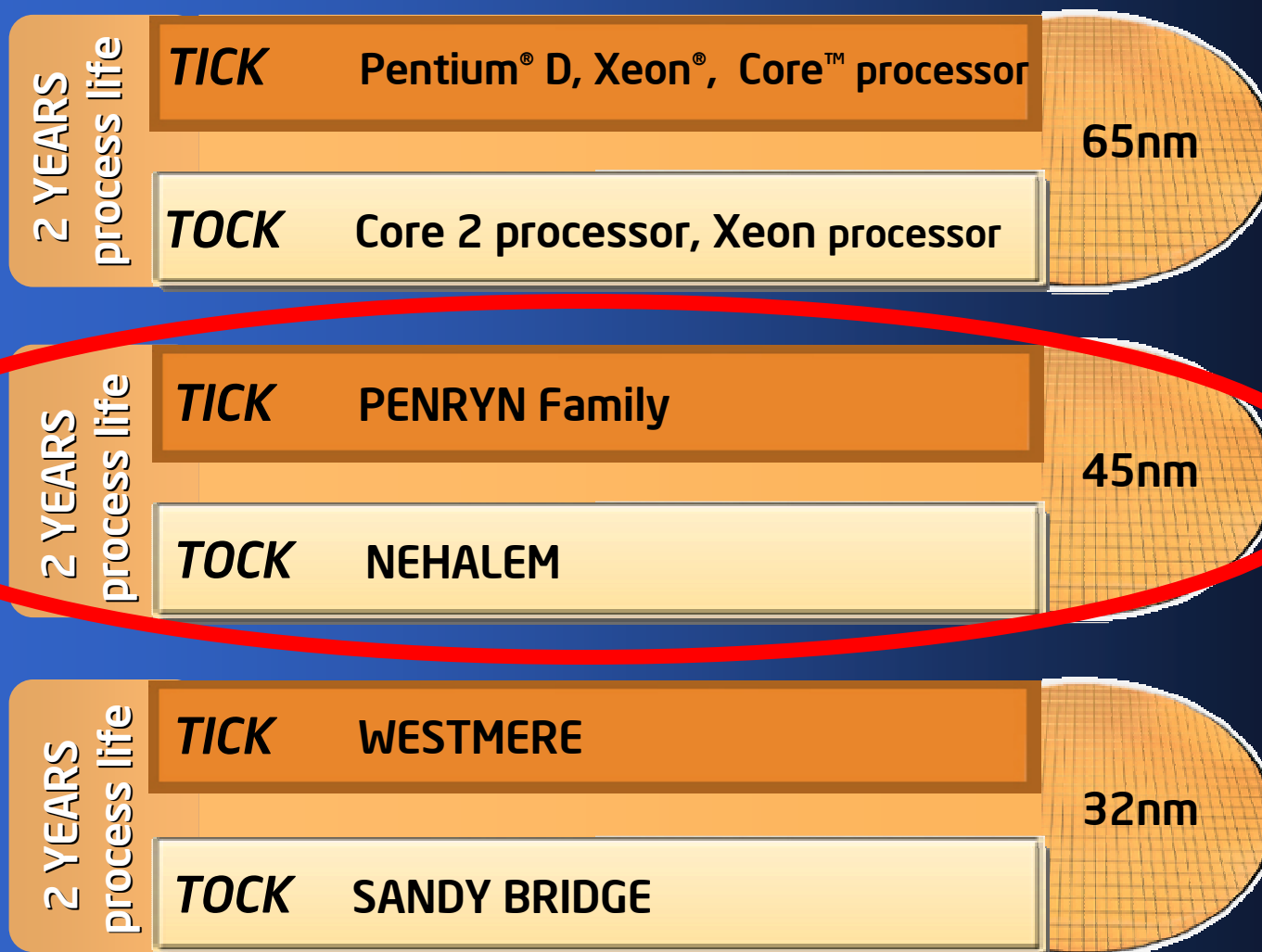
Enhanced Intel® Core™ Microarchitecture

– Details Covered In These IDF Sessions

- **TCHS001** [Tuesday, 2pm, Room 2001-2003]
Buckle Up: It is Penryn inside **Speakers:** Steve Pawlowski & Ofri Wechsler
– in depth on Penryn and high-level view of Nehalem next gen microarchitecture
- **IPTC001** [Tuesday, 5:10pm, CT-1]
45nm Next-Generation Intel® Core™ Microarchitecture (Penryn) and Intel® SSE4 - Chalk Talk **Speakers:** Stephen Fischer, Kiefer Kuah, Karthik Krishnan
- **IPTS001** [Tuesday, 3pm, Room 2001-2003]
Technical Overview of the 45nm Next-Generation Intel® Core™ Microarchitecture (Penryn) **Speaker:** Stephen Fischer
- **IPTS002** [Tuesday, 5:10pm, Room 2001]
Tuning for Intel® SSE4 on the 45nm Next-Generation Intel® Core™ Microarchitecture (Penryn) **Speakers:** Karthik Krishnan & Jeremy Saldate
- There are more tracks & sessions focused on High Performance Computing, Workstations, Server, and Desktop segment platforms



Sustained Leadership



New process generation
New product architecture

Intel® Notebook / Desktop Roadmap

4Q'07  Future

**Desktop Extreme
segment
processors**

45nm Desktop Intel® Core™ 2 Extreme processors
(Intel shipments and OEM availability in 4Q'07)

Intel® X38, P35 Express & OEM Chipsets

**Nehalem
Processors**

Future Chipset

**Desktop
Performance /
Mainstream
segment
processors**

**Q6000s,
E6000s,
E4000s
(65nm)**

45nm Desktop Intel® Core™ 2 Quad, Duo processors
(Intel shipments in 4Q'07, OEM availability in 1Q'08)

Intel® 3 Series & OEM Chipsets

**Nehalem
Processors**

Future Chipset

**Mobile Extreme
segment
processors**

**X7900
(65nm)**

45nm Mobile Intel® Core™ 2 Extreme processors
(Intel shipments in 4Q'07, OEM availability in 1Q'08)

Intel® & OEM Chipsets

**Nehalem
Processors**

Future Chipset

**Mobile
Performance /
Mainstream
segment
processors**

**T7000s
(65nm)**

45nm Mobile Intel® Core™ 2 Duo processors
(Intel shipments in 4Q'07, OEM availability in 1Q'08)

Intel® & OEM Chipsets

**Nehalem
Processors**

Future Chipset

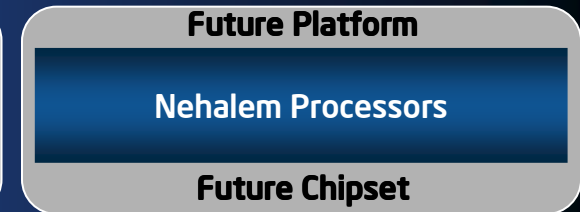
45nm Intel® Silverthorne processors
(available beginning in 1H'08)



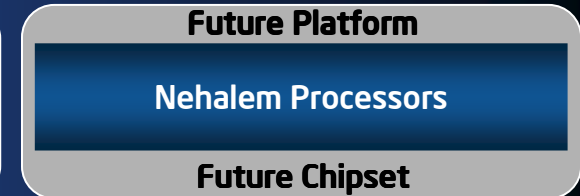
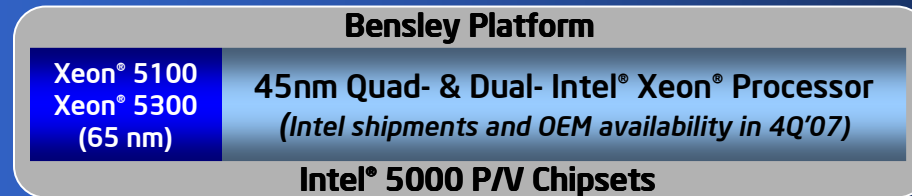
Intel® Xeon® Enterprise Roadmap

4Q'07  Future

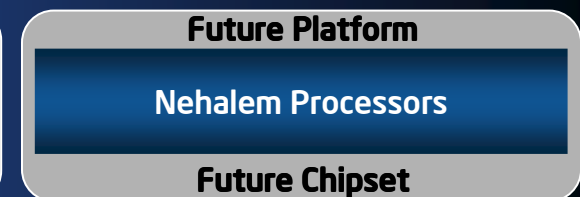
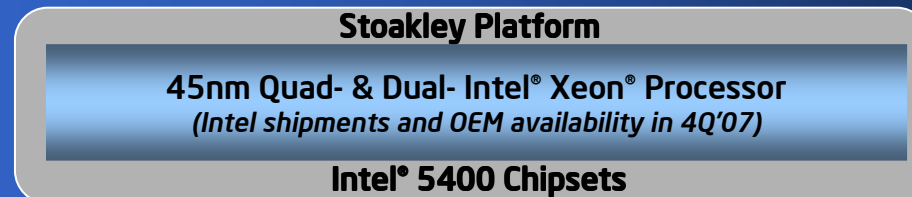
**Intel® Xeon® MP
7000 Sequence**
(Expandable)



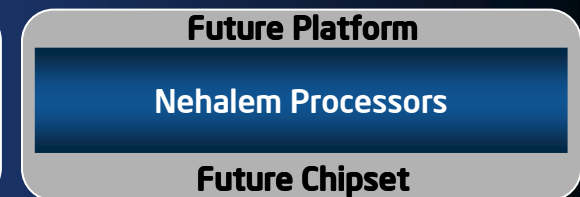
**Intel® Xeon® DP
5000 Sequence**
(Efficient Performance)



**Intel® Xeon® DP
5000 Sequence**
(Workstation & HPC)



**Intel® Xeon® UP
3000 Sequence**
(Entry)



45nm Intel® processors ramp first in Enterprise



Intel® Penryn Family

Server

Intel Xeon® processor families

Quad-Core Harpertown

- 12 MB Cache
- 120W, 80W, 50W
- Available: 4Q'07

Dual-Core Wolfdale-DP

- 6 MB Cache
- 80W, 65W, 40W
- Available: 4Q'07

Dunnington

- Socket compatible with Intel Xeon 7300 series
- Available: 2H'08

Desktop

Intel Core™ 2 Extreme & Intel Core 2 Quad Processors (Yorkfield)

Quad Core

- Up to 12MB Cache
- 95W (MS)
- 130W (XE)
- Available:
4Q'07 = Extreme
1Q'08 = Mainstream

Intel Core 2 Duo Processors (Wolfdale)

Dual Core

- Up to 6MB Cache
- 65W
- Available: 1Q'08

Mobile

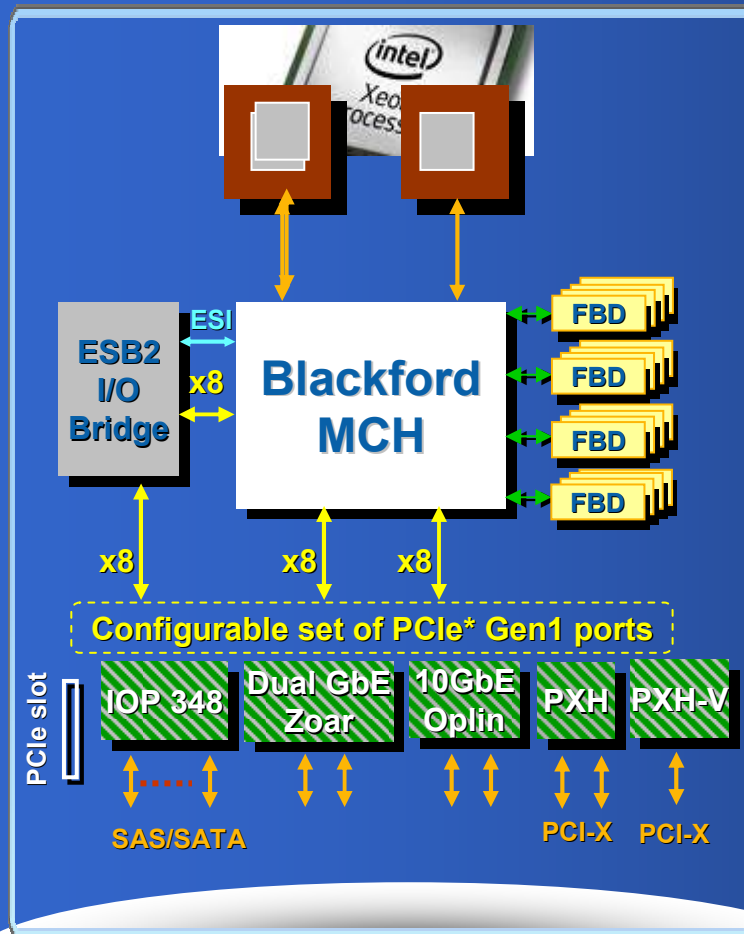
Intel Core 2 Extreme & Intel Core 2 Duo Processors (Penryn)

- Next evolution of dual-core power efficiency
- Up to 6MB L2 Cache
- Variety of wattages
- Available: 1Q'08

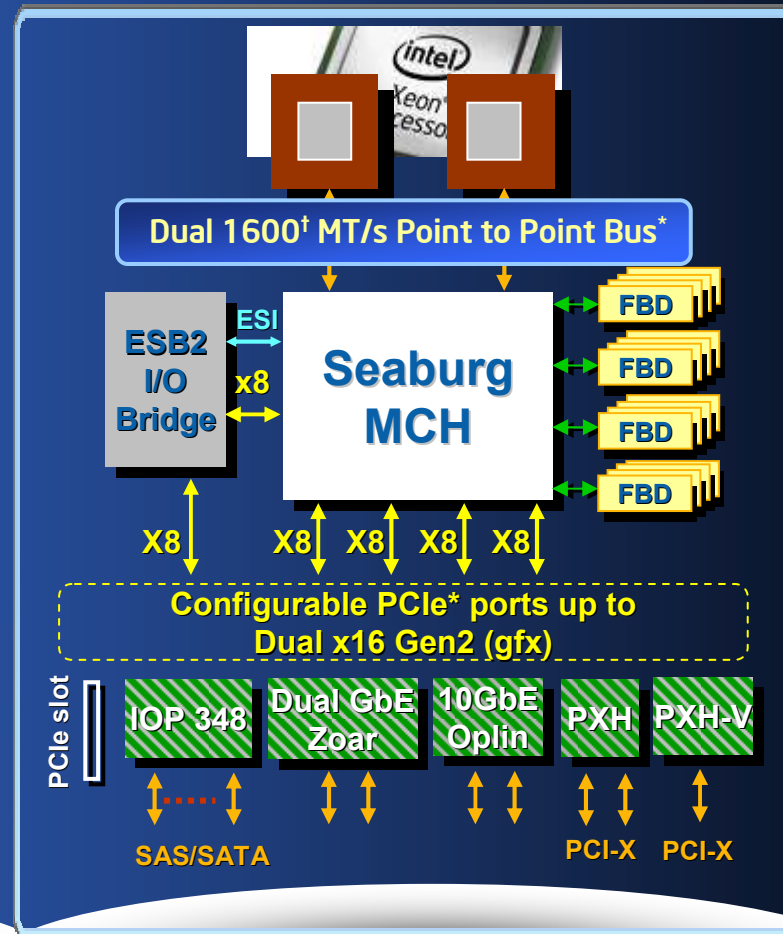
Shipping 45nm Products in All Segments 4Q'07



Energy Efficient Enterprise Platforms



Bensley Platform
Server Platform



Stoakley Platform
Workstation and HPC Platform

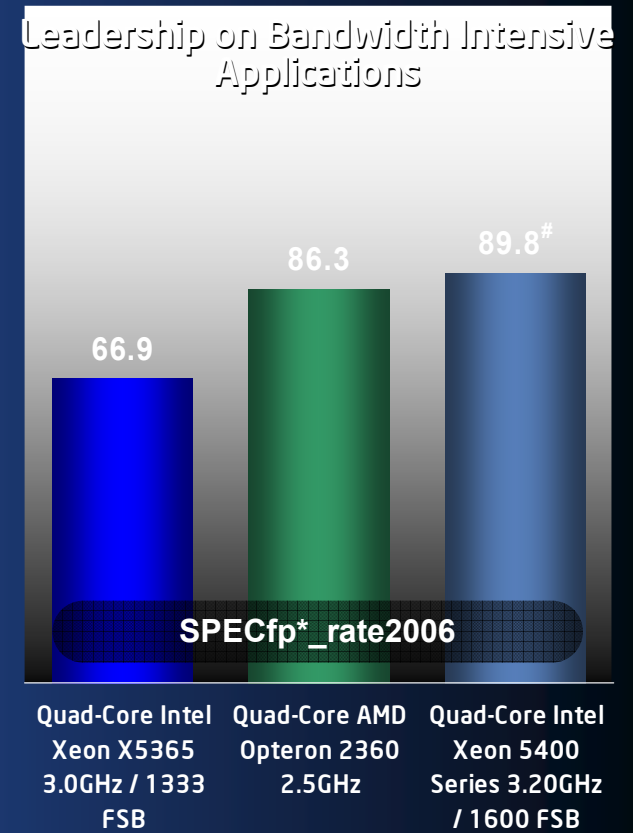
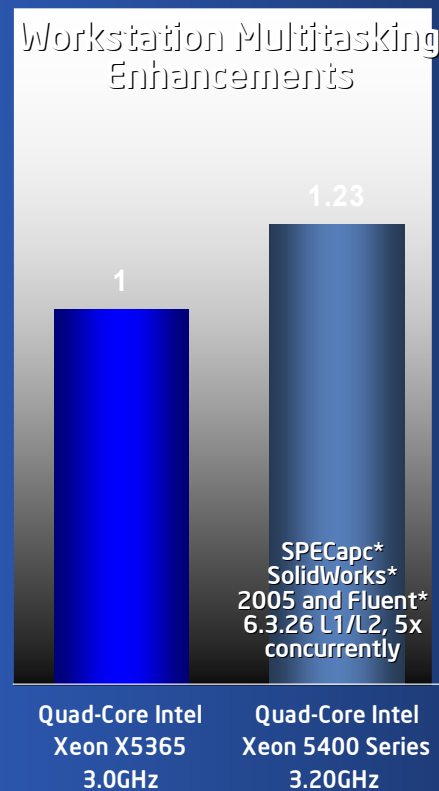
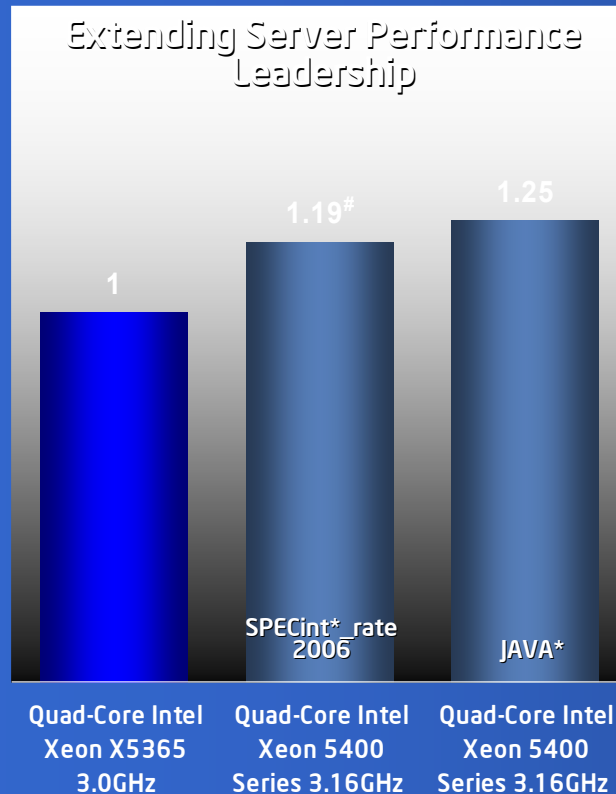
† 1600 MT/s limited to Stoakley platform only

* not all features are supported on all SKUs



45nm Hi-k Intel® Xeon® Quad-Core Processor

Performance Comparisons



Extending Performance Leadership!

[#] Intel estimates based on internal measurements September 2007

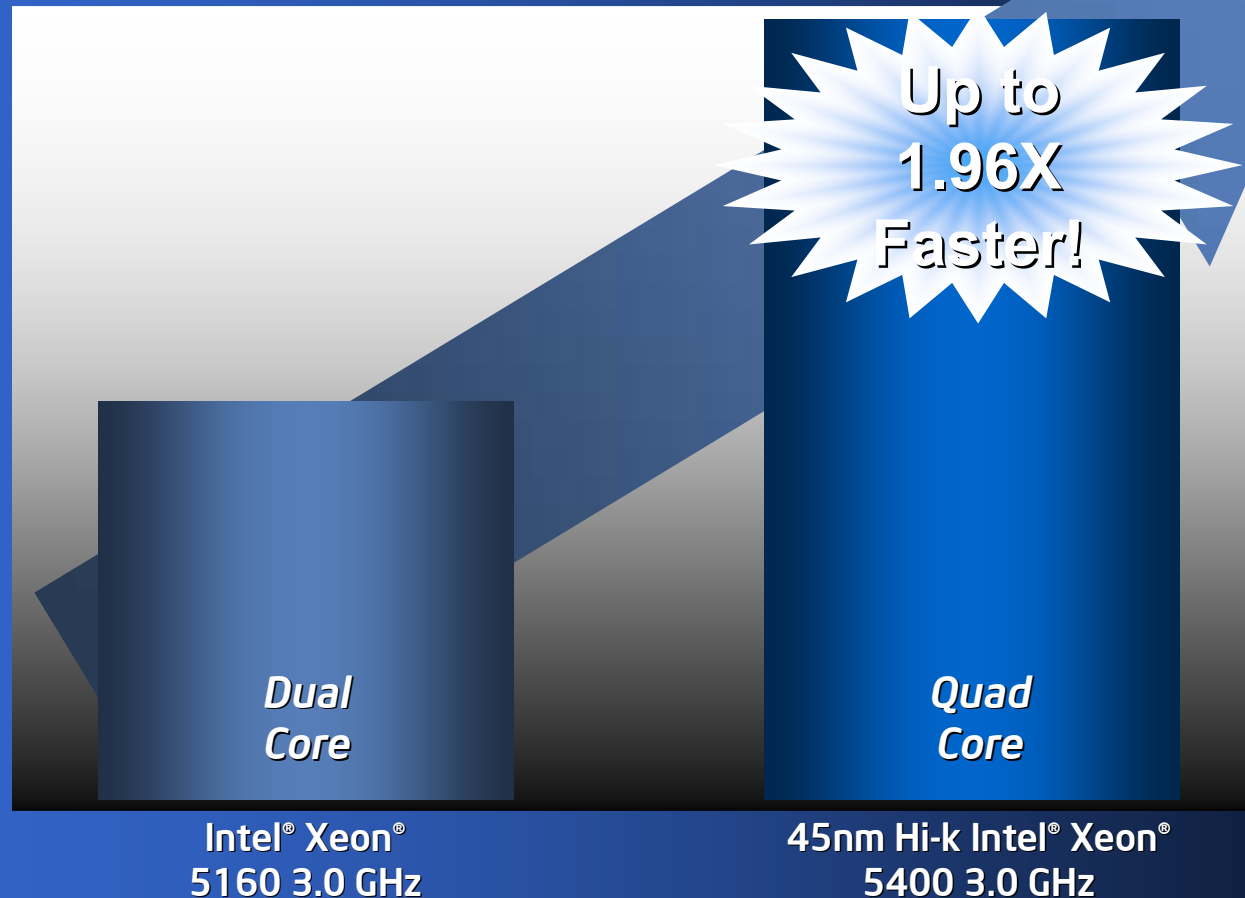
SPEC, SPECint2006, SPECfp2006, SPECapc are trademarks of the Standard Performance Evaluation Corporation. See <http://www.spec.org> for more information. SPECfp_rate2006 comparison based on best reported 2 socket AMD and Intel results. Source for Quad-Core AMD Opteron: www.amd.com. Source for Quad-Core Intel Xeon Processor X5365: www.spec.org, Current as of 9/13/2007

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Paradigm Benchmark¹ with Intel® Xeon® Processors

Relative Jobs/Day



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DATA SOURCE: Intel® Corporation Internal Measurement results as of September 1, 2007. See back up for configuration details.
Relative performance for each benchmark is calculated by taking the actual benchmark result for the first platform tested and assigning it a value of 1.0 as a baseline. Relative performance for the remaining platforms tested was calculated by dividing the actual benchmark result for the baseline platform into each of the specific benchmark results of each of the other platforms and assigning them a relative performance number that correlates with the performance improvements reported.



Intel® Core™ 2 Extreme QX9650

Next Gen 45nm Quad-Core

Quad-Core:
4 cores / 4 threads

3.0 GHz Core Frequency
(initial offering)

Larger 12MB L2 Cache

PC industry's first 100%
Lead free processor

Technologies*:

- Intel® 64
- Enhanced Intel SpeedStep® Tech
- Execute Disable Bit
- Intel® Virtualization Tech

1333 MHz FSB

LGA 775 socket

FMB: 130W



**Enhanced Intel® Core™
Microarchitecture**

45nm process technology:
• Higher Performance
at same TDP

New SSE4 Instructions:

- Improved Multi-media
- Enhanced Video Encode and Decode
- Improved Photo Editing

Overspeed protection¹
removed

Supported by the Intel® X38
and P35 Express Chipsets

¹Warning: altering clock frequency and/or voltage may (i) reduce system stability and useful life of the system and processor; (ii) cause the processor and other system components to fail; (iii) cause reductions in system performance; (iv) cause additional damage; and (v) affect system data integrity. Intel has not tested, and does not warrant, the operation of the processor beyond its specifications.

*Certain features may be available only on particular SKUs



Intel® X38 Express Chipset

Performance

- PCI Express 2.0 Dual x16
- DDR3 1333
- Intel® Fast Memory Access
- Intel® Turbo Memory†

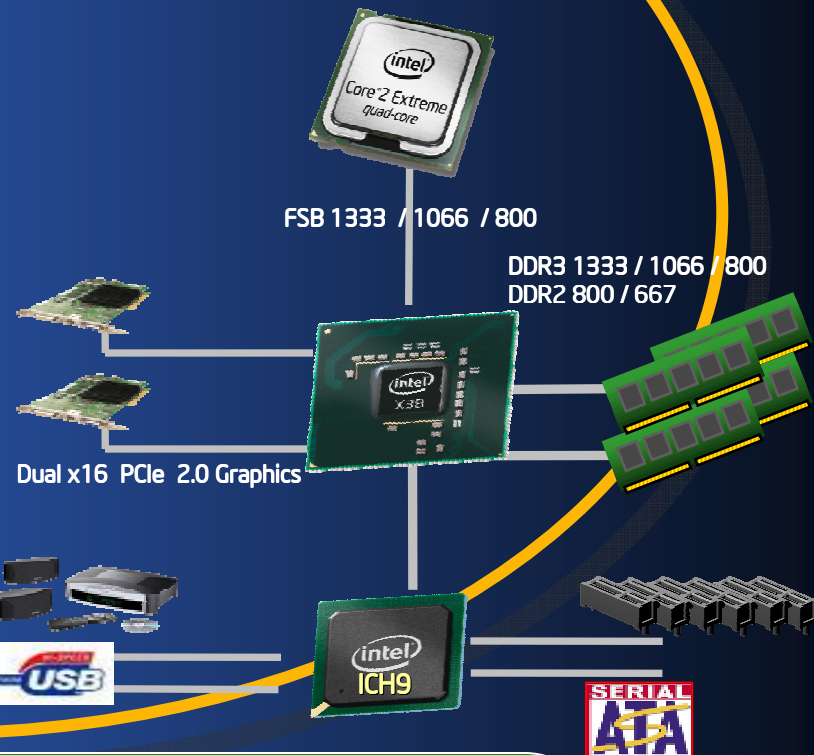
Tuning

- Intel® Extreme Memory
- Intel® Extreme Tuning Utility
- Flexible (unlocked) bus ratios

Technology

- Support for existing 65nm & new 45nm Intel® Core™2 Extreme processors as well as mainstream Intel Core 2 Quad, Duo processors
- Greater performance in the same power envelope

The Intel® X38 Express Chipset has been shipping for some time & will be broadly available from OEMs soon

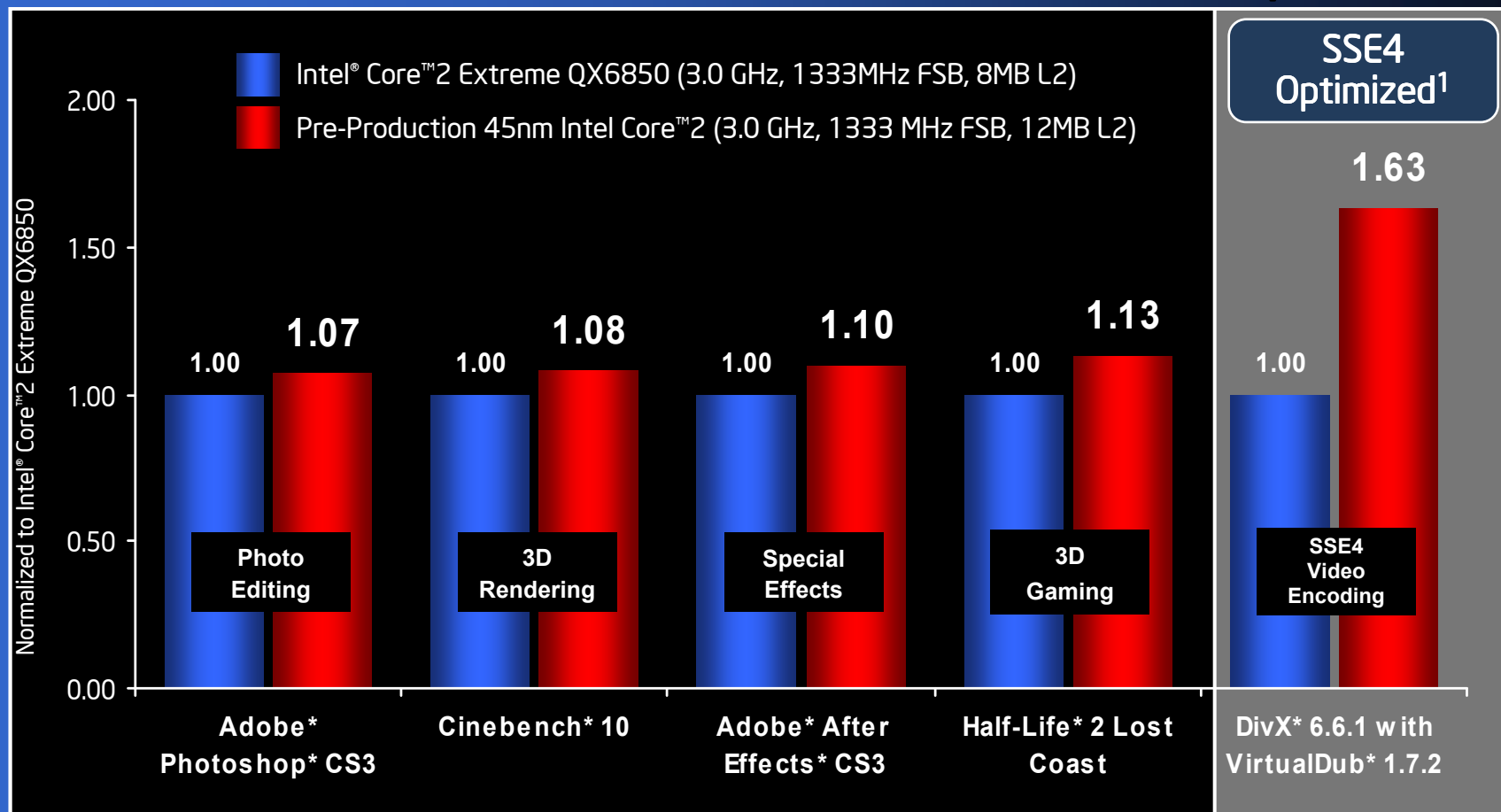


**QX9650 + X38 Express
Extends Existing Performance Leadership**



† Some features may not be available at launch

3.0 GHz Quad-Core Performance Comparison



¹SSE4 support in DivX® 6.6 is experimental. Data is subject to change.

Microarchitecture improvements combined with a 12MB L2 cache and SSE4 improve upon Intel® Core™2 processor performance even at the same clock speed

Source: Intel. **Configuration:** Intel® Core™ 2 Extreme QX6850 (8MB L2, 3.0 GHz, 1333MHz FSB) and Pre-Production 45nm Intel Core™2 Processor (12MB L2, 3.0 GHz, 1333MHz FSB) on Intel DX38BT board, Intel Chipset INF 08.30.1013, 2x1GB Dual Channel Corsair® DDR3-1333 9-9-9 -24, Seagate® 320GB Barracuda® NCQ Serial ATA 7200 RPM, Windows® Vista® Ultimate 32bit. Performance tests and ratings are measured using specific computer systems and / or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, visit <http://www.intel.com/performance/>



Intel® Server Board X38ML

*X38 Express chipset , 1333 FSB
Single PCI-Express Gen 2 x16 connector
Up to 4 DIMMs (8GB)
DDR2 667/800 memory w/ ECC
Integrated 4 port SATA
3.0Gb/s with RAID 0,1,10
Integrated Dual Gigabit Ethernet (Zolar)*



Intel® Server System SR1520ML

*shown with included heat sinks,
PCI-E x16 risers, 2.5" drive carriers*



"45nm Tock"—Nehalem

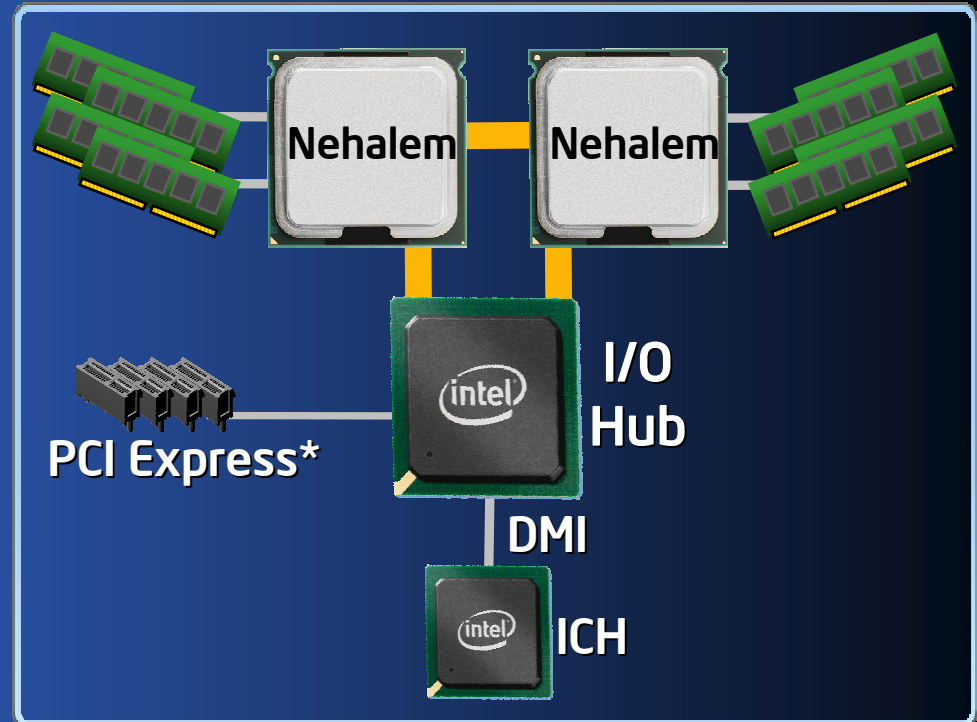
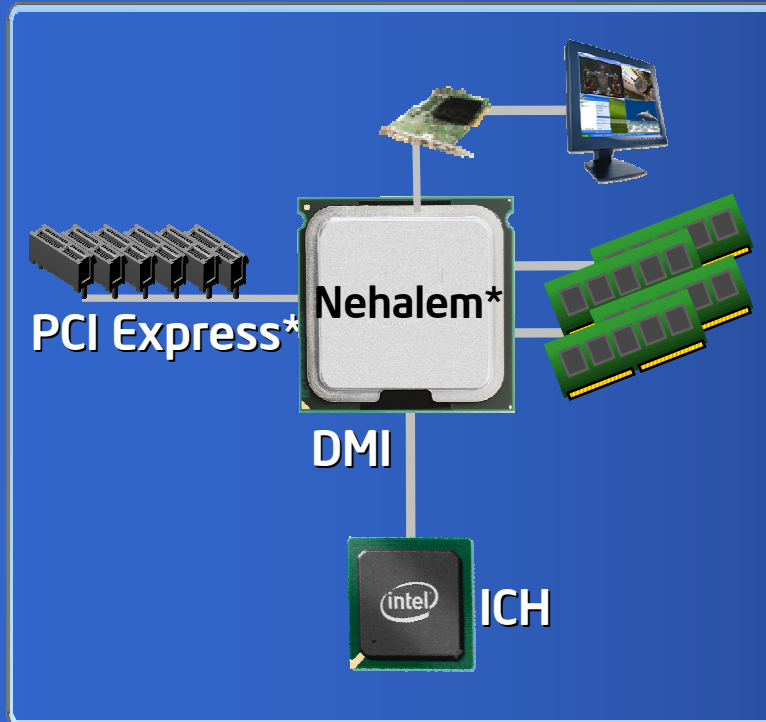
Dynamic Scalability for Efficient Performance on Demand

Fully Unlocks Intel 45 nm High-k Silicon Benefits	Leverages 4 Issue Intel® Core™ Micro- architecture Technology	Dynamically Managed Cores/ Threads/ Caches	Simultaneous Multi- threading	Multi-level Shared Cache Architecture	Performance Enhanced Dynamic Power Management
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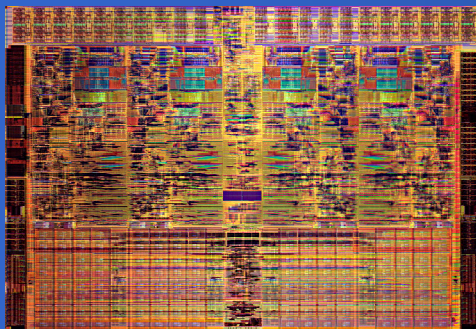
Design Scalability Optimizes for Each Market Segment

New System Architecture Includes QuickPath Architecture	Scalable & Configurable Cache, Interconnects & Memory Controllers	Optional High Performance Integrated Graphics For Client	Scalable Performance: 1 to 16+ Threads & 1 to 8+ Cores	Initial Products in Production in '08
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Nehalem Based System Architecture



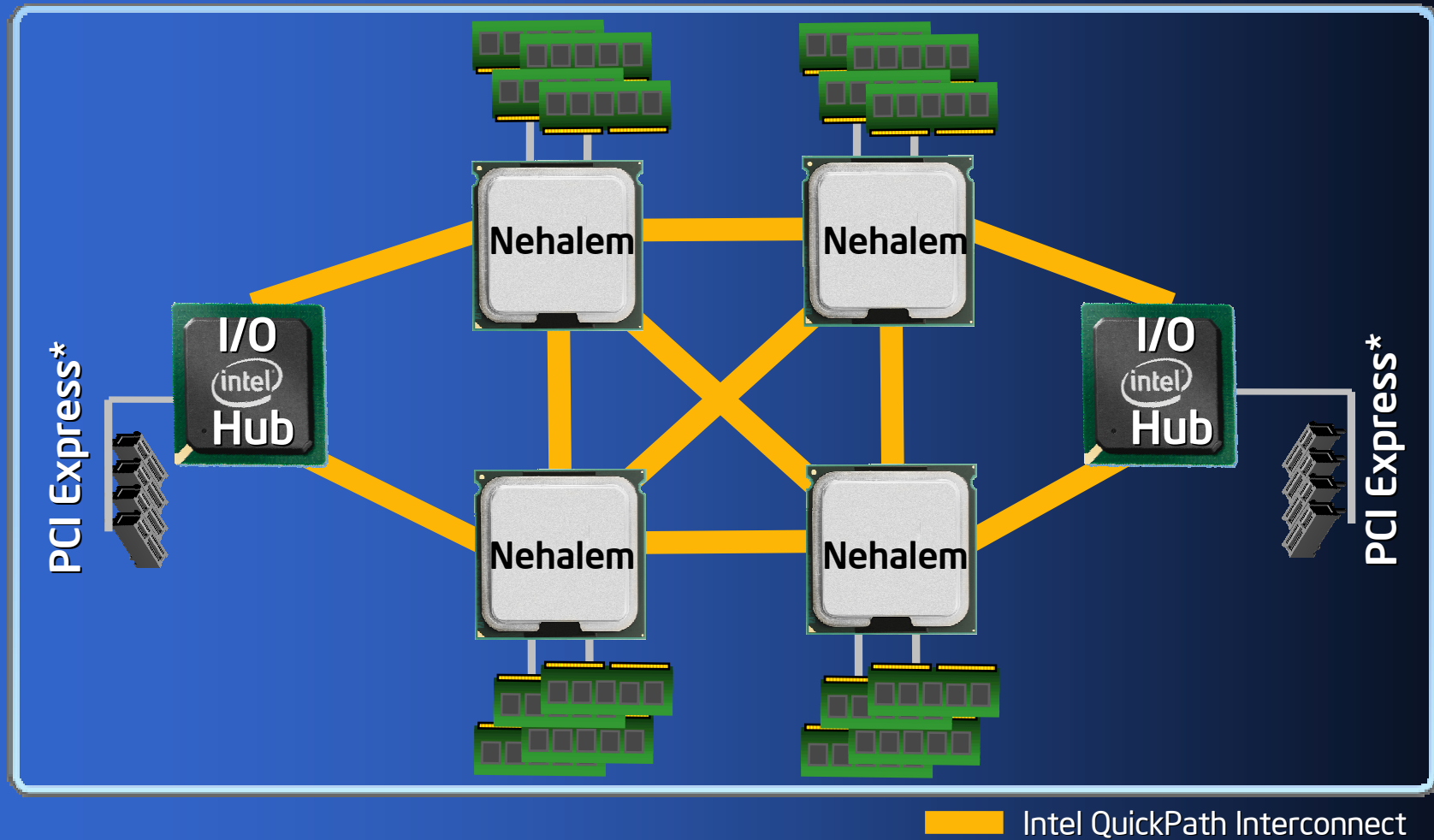
Intel QuickPath Interconnect



- 2, 4, 8 Cores, 4, 8, 16 Threads
- Intel® QuickPath Architecture
- Buffered or Unbuffered Memory
- Optional Integrated Graphics
- Integrated Memory Controller



Nehalem Based 4S System Architecture



Summary

- New generation 45nm process technology enhanced Intel® Core™ Microarchitecture shipping in 4Q'07 across all segments
- New Stoakley DP server segment platform & 45nm processors provide boost for High Performance Computing
- New Intel® X38 Express chipset based platform with new 45nm quad-core Intel® Core™ 2 Extreme processor hits new heights of performance in the same power envelope
- 45nm Hi-k advances allow Intel to address multiple diverse segments from low power IA *Silverthorne* to *Nehalem*

Customers benefit from Intel leadership in manufacturing, micro-architecture, and product development



Thank You



45nm Hi-k Intel® Xeon® Quad-Core Processor

Performance and Energy Efficiency Comparisons configuration details

- Extending Server Performance Leadership
 - SPECint_rate2006
 - Quad-Core Intel Xeon processor X5365 based platform details: Supermicro* X7DB8 with two Quad-Core Intel Xeon processors X5365 3.0GHz, 16 GB memory (8x2GB), 1333 FSB, O/S 64-Bit SUSE Linux Enterprise Server 10, Kernel 2.6.16.21-0.8-smp for x86_64, Intel C++ Compiler for Linux version 10.1 & Smart Heap Library Version 8.1. Published at www.spec.org as of September 4th 2007.
 - 45nm Hi-k Intel Xeon Quad-Core processor 3.16Ghz based platform details: Intel pre-production platform with two 45nm Hi-k Intel Xeon Quad-Core processors 3.16GHz, 1333 FSB, 16 GB memory (8x2GB), O/S 64-Bit SUSE Linux Enterprise Server 10, Kernel 2.6.16.21-0.8-smp for x86_64, Intel C++ Compiler for Linux version 10.1 & Smart Heap Library Version 8.1.
 - **Java (Server side Java* benchmark)**
 - Quad-Core Intel Xeon processor X5365 based platform details: Intel pre-production platform with two Quad-Core Intel Xeon processors X5365 3.0GHz, 16 GB memory (8x2GB), 1333 FSB, Microsoft Windows Server* 2003 Enterprise x64 Edition + SP1 (64-bit), BEA* JRockit* 5.0 P27.2.0. Result measured with 4 JVM instances.
 - 45nm Hi-k Intel Xeon Quad-Core processor 3.16Ghz based platform details: Intel pre-production platform with two 45nm Hi-k Intel Xeon Quad-Core processors 3.16GHz, 16 GB memory (8x2GB), 1333 FSB, Microsoft Windows Server* 2003 Enterprise x64 Edition + SP1 (64-bit), BEA* JRockit* 5.0 P27.2.0. Result measured with 4 JVM instances.

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45nm Hi-k Intel® Xeon® Quad-Core Processor

Performance and Energy Efficiency Comparisons configuration details

- Leadership on Bandwidth Intensive Application
 - SPECfp_rate2006
 - Quad-Core AMD Opteron 2350 based platform details: Result published at www.amd.com at http://www.amd.com/us-en/Processors/ProductInformation/0,,30_118_8796_8800~119102_00.html. x Quad-Core AMD Opteron™ processors Model 2360 SE in Supermicro H8DMU+ motherboard, 16GB (8x2GB DDR2-667 memory), 250GB Seagate SATA disk drive, SuSE Linux Enterprise Server 10 SP1 64-bit kernel as of Sept 13, 2007. Result published at 86.3
 - Quad-Core Intel Xeon processor X5365 based platform details: Supermicro* X7DB8 with two Quad-Core Intel Xeon processors X5365 3.0GHz, 16 GB memory (8x2GB), 1333 FSB, O/S 64-Bit SUSE Linux Enterprise Server 10, Kernel 2.6.16.21-0.8-smp for x86_64, Intel C++ Compiler for Linux version 10.1 & Smart Heap Library Version 8.1. Published at www.spec.org as of September 4th 2007 at 66.9.
 - 45nm Hi-k Intel Xeon Quad-Core processor 3.20Ghz based platform details: Intel pre-production platform with two 45nm Hi-k Intel Xeon Quad-Core processors 3.20GHz, 1600 FSB, 16 GB memory (8x2GB), O/S 64-Bit SUSE Linux Enterprise Server 10, Kernel 2.6.16.21-0.8-smp for x86_64, Intel C++ Compiler for Linux version 10.1 & Smart Heap Library Version 8.1. Result measured at 89.8.
- Workstation Multi-Tasking Enhancements - Manufacturing “Working Differently” scenario SPECapc* SolidWorks* 2005 and Fluent* 6.3.26 L1/L2 workloads running 5x concurrently
 - 2x Quad-Core Intel® Xeon® Processor 5400-series (3.20 GHz, 1600 MHz FSB, 12 MB cache, formerly “Harpertown”) on “SunCity Stoakley” pre-production workstation compared to 2x Quad-Core Intel Xeon Processor X5365 (3.00 GHz, 1333 MHz FSB, 8 MB cache) on SuperMicro* X7DA8 workstation, COMMON: 8 GB FBD-667 memory, WDC WD740GD HDD, Windows XP* Professional x64 SP1, NVIDIA* Quadro* FX 4500 PCIe* x16 video card driver 91.36.

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Processor Microarchitecture Comparison

	65nm Intel® Core™ Microarchitecture	45nm Hi-k Penryn	AMD K8	Barcelona
Production Date	1H 2006	2H 2007	2003	2H 2007
Clock Frequency	3GHz	Up to >3GHz Demo'd 3.33GHz	3GHz	>2Ghz Demo'd ?
Technology	Intel 65nm	Intel 45nm Hi-K+Metal Gate	90nm/65nm	65nm
Cache	Shared L2 Higher BW 256bit data width	24 way Shared L2 Higher BW 256bit data width	Dedicated L2 64 bit data width	Shared L3 128 bit data width
Total L2/L3 Cache	Up to 8MB	Up to 12MB	Up to 2MB	Up to 4MB
Memory Access	Improved Prefetch 3 Pre-fetchers Memory Disambiguation DDR-2/3	Decreased Latency 3 Pre-fetchers Memory Disambiguation DDR-2/3	Integ. Mem. Controller 2 Pre-fetchers DDR-2	Integ. Mem. Controller 2 Pre-fetchers DDR-2
Issue Width	4 Issue	4 Issue	3 Issue	3 Issue
Pipeline Efficiency	14 Stage Speculative OOO Loads/Stores Macro & Micro Fusion	14 Stage Speculative OOO Load/Store Macro & Micro Fusion	12 Stage No load/store re-ordering	12 Stage No load/store re-ordering
System Bus	Up to 1333 MHz	Up to 1600 MHz	1000 MHz	1000MHz
SSE	Intel SSSE3 ISA 128 Bits/Cycle	Intel SSE4 ISA 128 Bits/Cycle	SSE3 (Equiv) 64Bits/Cycle	SSE3 (Equiv) 128Bits/Cycle

All product information and dates are preliminary and subject to change without notice

